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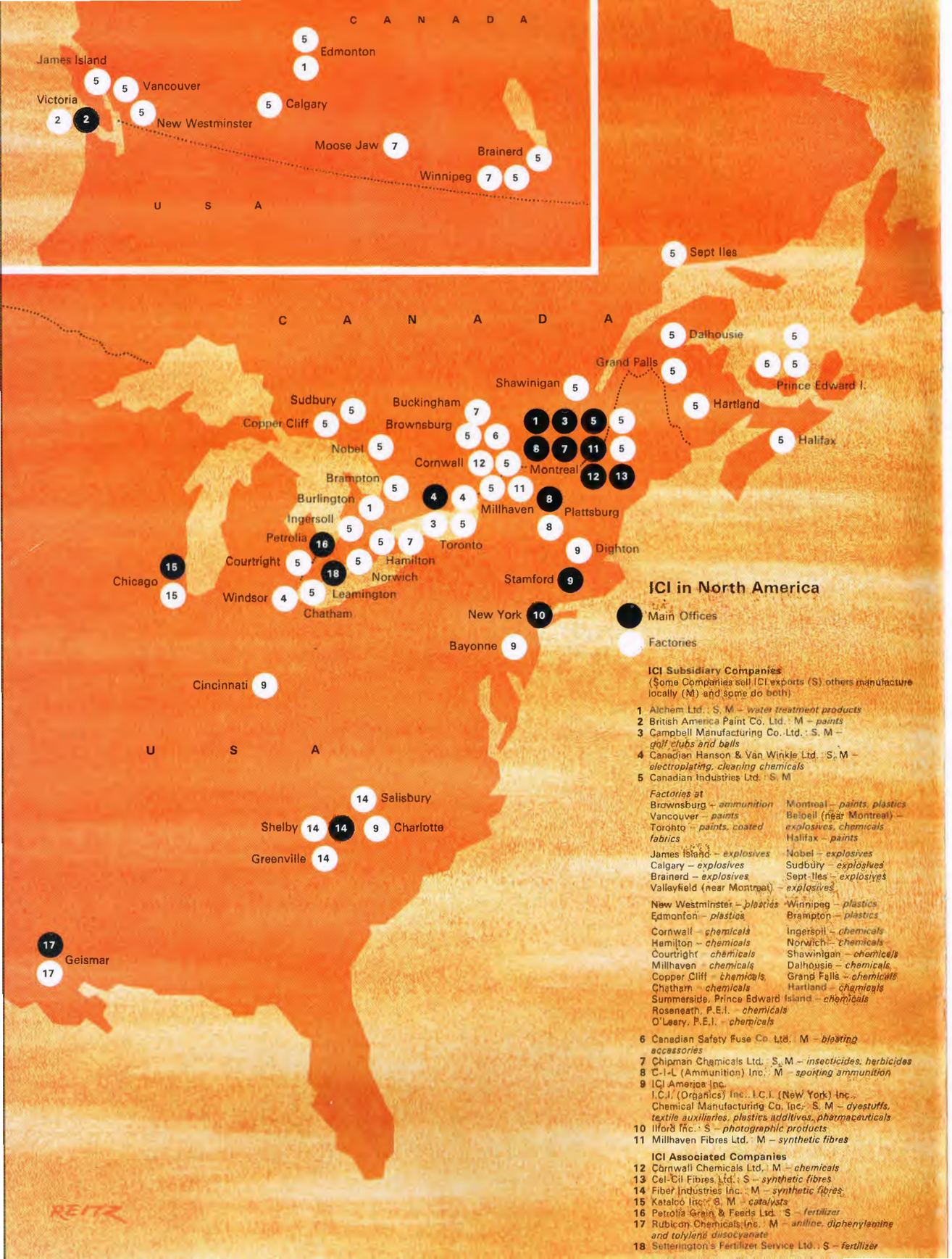

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Cover

Spraying plants, whether weeds to be destroyed or crops to be protected from pests or diseases, is the essence of Plant Protection's multi-million pound international trade.
Photograph : Otto Karminski

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harvests of progress

'Farmers in most countries are prepared to accept new ideas—if you can show them it pays'—Geoffrey Watts Padwick, Overseas Director of PPL: based at Fernhurst, Sussex

Behind the granting of a Queen's Award to Industry for export achievement to Plant Protection Ltd., the ICI subsidiary based at Fernhurst, Sussex, which forms part of Agricultural Division and which invents, develops and markets crop protection chemicals throughout the world, lies much more than the fact that their exports have risen threefold in four years or that 60% of output is now being exported to over 100 countries.

It is a story of long, patient research into the fundamental properties of plants, chemicals and soil alike, calling for co-operation between many different scientific disciplines – chemistry, biology, physics – supported by the techniques of the agricultural specialist, the mechanical engineer and the salesman. The early things that mattered were the cocoa pests and diseases, seed dressings for wireworm control, cotton seed treatment, and blister blight in tea; for all these Plant Protection were the first to provide a solution with the use of their chemicals. From the integrated efforts of all these different workers has come a complete revolution in the approach to weed control. For the recent growth in exports has been largely due to a new group of bipyridyl herbicides – 'Gramoxone' and 'Reglone,' discovered and developed throughout by Plant Protection. Contact killers of green vegetation, these bipyridyls act on a wide range of plants, kill both broadleaved and grass weeds, are quick in action and little affected by weather. They lose their herbicidal properties almost immediately on contact with the soil and eventually break down into harmless simple chemicals.

'One of the fascinating things about this work,' says **Dr. Geoffrey Watts Padwick**, Overseas Director, 'is the speed with which one makes contact with farmers the world over. It doesn't matter whether they are wheat farmers in Canada or tea planters in Ceylon, coffee growers in Kenya or Costa Rica, rubber planters in Malaya, or small cocoa farmers in Nigeria. If you can understand their problems, you make friends with them very quickly.

'My own job is to ensure that we select the markets for PPL products which will be most profitable over a long period, and take all the steps necessary, in commercial operation and technical service, to exploit them fully and profitably so that exports continue to grow.'

The inventive side of the work is done in Britain. As products are developed, they are passed out for testing in the UK under British farming conditions. The highly-controlled work at this stage involves not only complex and detailed experiments but also testing on a semi-commercial scale by selected farmers. This develops the product to the point where it can be commercially sold in Britain. But the successful development of a chemical for the UK may not imply success in the very different conditions overseas. The home market provides useful guide lines, but the work cannot be simply transplanted abroad. 'This explains why we set up the Overseas Development Department three years ago, which carries out research in a number of different countries.

'My task, together with Alan Maier, our European Sales Director, is to assess the market correctly for the 100 countries to which PPL exports its products. Not only are crops and conditions extremely variable, but there are nearly always many competitive products. If we find a new insecticide effective against greenfly, for example, we must think of all the crops in 100 countries where greenfly and other aphids are important and try to decide if the product would be effective and safe and economical to use – and whether it could compete. To do this we must make frequent visits to examine conditions on the spot.' Second need is to assess the economic and political trends: 'Many of our most attractive markets are in countries which present difficulties, e.g. West and East Africa, India, Indonesia and various South American republics. The answer here is to be flexible, shifting our emphasis as the political and economic climate changes. Finally, we have to stimulate and maintain the enthusiasm of our agents all over the world.'

Peasant farmers, even in the developing countries, have proved surprisingly willing – and able – to accept chemicals often involving sophisticated techniques. 'I thought it would be a slower, more time-consuming process, but having been shown how profitable these techniques were, they took to them like ducks to water. For example, take the spraying of cocoa for the control of capsids in Ghana and Nigeria and the control of black pod with 'Perenox' in Nigeria. I was surprised at the completeness with which they took to these operations. Of course the farmers were subsidised by the government, but they had to pay a large part of the cost and it involved them in a great deal of work.

'But all they wanted really was proof that this was a profitable thing to do. Having proved that, they were as keen as any big wheat grower in this country or any leading farmer to adopt a technique which paid off. This is enormously encouraging, because one hears a great deal of despairing criticism over the food problems of the world. Critics say it is going to be so difficult to persuade these people to adopt modern techniques that are a bit hard to understand. That is not so. Farmers in most countries adopt new ideas if you can show them it pays.

'What I enjoy most is first forecasting future developments, and then picking and training the men to convert those forecasts into facts.' Quite a few PPL forecasts have been turned into facts since 1958: 'In eight years between 1958 and 1966 our sales have more than trebled and our exports have nearly quintupled.

'Plant Protection has profoundly influenced the economics of producing certain crops, for example cocoa, tea, coffee and rubber, and in the future we expect to make a similar impact on the growing of many cereal crops, including rice. We pioneered the use of important insecticidal and fungicidal sprays such as 'Gammalin' based on BHC and 'Perenox,' the copper-based fungicide. Now we are concentrating our efforts on the herbicide 'Gramoxone' and the desiccant 'Reglone.' We have already succeeded in selling them in quantity to Western and Eastern Europe, to the United States and to Japan, all highly-sophisticated countries who manufacture crop protection chemicals of their own invention. We have had equal success in both the more sophisticated countries and the developing or emerging nations.'

Top left: South Africa needs weed control for her vines. In this experimental vineyard Dr. Ken Drake (Overseas Development) talks over some results with Peter Pearman (Export Department)

Top right: Ecuador is the world's leading banana producer. Technical service man Graham Strickland passed this banana barge on his way up the River Guayas to demonstrate 'Gramoxone' in a plantation

Left: Holland – 'Gramoxone' kills weeds under water, too. It is the only sub-aquatic weedkiller allowed in the canals

Above: Mexico is a key market, growing coffee on 700,000 acres. Mike Chambers, technical service officer, on a two-day mule trek high into the mountains of the South to demonstrate 'Gramoxone'

harvests of progress

the discoverers

Bill Boon, PPL's Director of Research at Jealott's Hill Research Station, Berks

'Jealott's Hill is no research ivory tower. It is the lifeblood of Plant Protection Ltd. The over-riding priority,' stresses **Bill Boon,** is to discover major products like 'Gramoxone' and 'Reglone' which will sell all over the world and make an adequate profit.' The cost of achieving a breakthrough is high, the 'critical path' long and involved. Few activities call for the co-ordination of so many disciplines, the consideration of so many, often divergent, factors: efficiency, safety, field conditions, long-term social implications, ingrained habits of mind in farmers at home and abroad, the variety of their requirements in 100 countries. The minimum time between an interesting observation in the laboratory which could lead to a commercial product, until the time that product is first sold, is at least five years and can be seven. This reflects the volume of work needed, especially to determine safety in use.

'Some investigations must start before the known value of the product is established. For full clearance in some countries a detailed toxicological investigation lasting over three years is needed. The Industrial Hygiene Research Laboratory of ICI at Alderley Park do all the medical side for us.' Meanwhile field testing must go forward, and careful study of the demand pattern at home and abroad. When dealing with natural forces, living tissues, human or animal nutrition, nothing can be left to chance. But technical and commercial decisions cannot be left too long: 'At the same time as the safety work, we had to carry out for 'Gramoxone' and 'Reglone' a minimum of three years' field experiments to assess their agricultural value. Meanwhile process development at the Division or building a plant takes about the same time. So decisions must be taken quite early and money committed before it can be completely justified.'

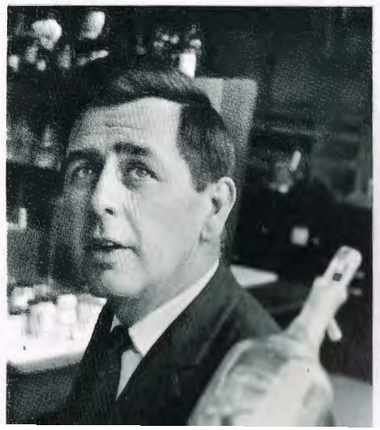
A key problem was the revolutionary nature of 'Gramoxone' and 'Reglone' in that they become inactive on touching the soil. Until then, 'every herbicide had a greater or lesser persistence in the soil, and the whole current of research and commercial thinking was directed to increasing this persistence. So the discovery of two products with virtually no soil persistence seemed to raise a lot of problems. Then we realised that this was not a drawback, but probably their biggest single advantage, allowing them to be used right up to the time the crop emerges and with careful spraying afterwards as well. With their other main advantages – consistent activity at low concentrations in the presence of light, and rapid action unaffected by rain immediately after use, they are potential world-beaters.

'The most exciting prospect opened up by this non-persistent action is their use over very large areas to replace the plough for weed control. This could bring enormous savings in time, labour and money, by allowing crops to be planted by direct drillings of seed through the mulch created by killing off the surface weeds or old greenstuff, or both. We are rapidly developing this technique and the machinery to apply it, particularly in the United Kingdom, Europe, Australasia, Canada, Argentina, Ceylon and Malaya.'

The skills of the chemists at Jealott's Hill and Yalding are deployed to produce agricultural chemicals which do their job efficiently and without undesirable after-effects or side-effects. **Dr. John Braunholtz,** manager of the Chemical Research Group, and his team, are equally concerned with the use of synthetic organic chemistry; in the search for new types of biologically active molecule; with the formulation and techniques needed to apply the chemicals effectively, economically and safely.

'Few people, even within ICI, realise how very many *entirely new* chemical compounds must be prepared and tested before a single new pesticide is discovered, or the surprising degree of variability which can occur between apparently similar biological experiments.

John Braunholtz



'We direct our own chemical synthesis to evaluate and exploit hypotheses and leads obtained from our own screening and from the relevant literature – and also to explore entirely new ideas springing from the intuition of people experienced in this field. This depends for its success on close collaboration between chemists and biologists. The skills of physicists and biophysicists, biochemists and physical chemists are then all employed to evolve and perfect not merely the right chemical but the best formulation for field use all over the world. We study the fate of chemicals on and in the plant and in the soil; we determine the factors that affect its take-up and movement within the biological system. We have to know just what we are doing to the target and its environment.'

The reactions of living tissue in hundreds of different kinds of crops, weeds, or pests in many different conditions of husbandry and climate are the preoccupation of **Ivor Darter,** Biological Research manager at Jealott's Hill. 'We put thousands of new organic compounds through screening tests designed to represent major crop problems. These tests are comparatively simple, but once we see there is something biologically effective in a compound, we characterise it in detail to find out just what it is and what it does.'

Glasshouse tests are never enough: 'If, from our glasshouse tests, we feel we have something worth exploiting, we have to follow up with field tests designed to show just how good our product is. Effects can be radically different out in the field, methods of application are much less precise and we probably have rain and wind to contend with. So if, for example, we have a compound that looks promising for the control of diseases in bananas or cocoa or coffee, we arrange trials in the West Indies or Nigeria or Kenya.

'We cannot take anything for granted without checking it thoroughly. Our people must be prepared to question what seem to be the simplest and most obvious agricultural operations. Only in that way can one realise the full potential of a new discovery. After all, if we had taken for granted all we were told about the place of 'Gramoxone' and 'Reglone' in world agriculture, we probably wouldn't have got off the ground with them!'

Ivor Darter

harvests of progress

the developers

Jim Cronshey

'Our job is entirely concerned with agricultural field experiments. We agree programmes with the agricultural side of our overseas companies. Then we base teams in these various countries, usually led by a graduate (often a Ph.D.) with several assistants.' **Jim Cronshey,** Overseas Development Manager, answers to Dr. Boon for the long-term experimental work overseas which develops the new techniques on which future sales of Plant Protection products will be based.

'Our relationship with our overseas companies is the foundation of our entire operation. Our programmes are agreed with them before we start work. Often the costs are shared.

'The greatest long-term potential probably lies with the vast areas of under-developed land in Asia, Africa, India and South America – particularly where the economy depends on one crop: with rice there's a very real prospect of greatly increasing productivity by minimum cultivation methods based on the use of 'Gramoxone.' These methods greatly shorten the time spent on preparing ricefields by hand and with bullocks. You can either get an extra rice crop in – or get the regular crop in at the best time. With this in mind, we have begun working in Ceylon and the Philippines and are planning programmes in Malaysia, Thailand and India.'

The overall development plan envisages 40 teams working in 19 countries, with programmes estimated to build up to a cost of £500,000 a year. Already, within 3½ years, 13 countries and about 90 people are involved.

New chemical products for the farmer frequently demand new machines to apply them, either modified from existing implements or specifically designed for the task. 'Our job,' says **David Harris,** assistant manager of Plant Protection's Machinery Department, 'is to ensure that machinery exists to enable all the Company's products to be correctly applied anywhere in the world.'

Usually, Plant Protection have to design and develop machinery which other companies make and market. The basic ideas are usually patented by PPL to safeguard the manufacturers concerned. 'Unlike most engineers we hardly ever have a detailed specification to work to. The requirements often cannot be precisely stated. When a machine has been developed no one can define where or when it will be used, what the soil type, conditions, or weather will be or what associated machinery will be available.'

Complete standardisation is impossible since every farmer has different ideas, every country different working conditions. At the moment there are two main lines of development, direct drilling machinery and the improvement of crop-spraying machines.

'The biggest machine we ever tackled was a seed treater for fuzzy cotton seed. This was in 1958 when there was a market for both copper- and mercury-based fungicides but no machinery in the world to do the job. So we developed a machine using principles already evolved for treating cereal seed in Britain.

'First trials in Nigeria led to immediate orders for two machines, later two more were supplied. Since then we have supplied another dozen to other African countries. This one machine gained and kept a market for Plant Protection.'

Work on non-drift spraying machinery started in 1961 when it became clear that completely safe spraying of the non-selective bipyridyl herbicides would be impossible with the equipment then available. 'For inter-row weed control, accurately-directed spraying is essential and there must be no fine mist-like spray to drift on to the crop, which may be only an inch away from the weeds. So we re-examined the principles of crop spraying, seeking to avoid on the one hand the combination of high pressures and small nozzles that cause mists, and yet realising the need to apply very large volumes of solution at low pressures to get good coverage. Our answer was an electrically-operated low-pressure nozzle, the 'Vibrajet,' that disperses low volumes of solution in such a way that good coverage is ensured but without creating a spray mist. Made for PPL by a subcontractor and now available commercially, the 'Vibrajet' received a silver medal in the new implements competition at this year's Royal Show and a trophy for the best new implement of the year.'

David Harris

As PPL's development officer for South-east England, **Eric James** (shown on page 155) is one of a team under Dr. Harry Allen that links Jealott's Hill with the technical representative and the farmer. New ideas must be tested on a field scale before being released commercially – the main job of the development officer is to organise these field trials.

Eric's territory covers some 5m. acres in six counties. 'Our climate,' he says, 'is perhaps a little better than in other UK districts and our borders contain some of the principal, and generally the earliest, grain-producing areas, as well as the finest fruit, hops and glasshouse crops, with an attendant variety of problems.'

A development officer's work falls into two main categories. First, technical service for farmers and growers. When the man on the spot – the merchant's salesman or the PPL technical sales representative – cannot help then the development officer comes in. Second, development involves running within his area the annual series of projects which are laid down by Jealott's Hill.

Examples are establishing crops by direct drilling or minimal cultivation, that is, implanting seed with little or no soil displacement. 'Not only cereals, but kale, oil seed rape, mustard and potatoes are being successfully grown with little or no cultivation. Pasture too can be renewed, using a technique developed by us in Britain and now spreading throughout the world. Using 'Gramoxone,' a farmer can turn an old, run-down pasture into a field of lush new grass in six weeks.

'Farm demonstrations are increasingly important to get our message across and usually need to be planned a long time ahead. They must be instructive and demonstrate practical and profitable ideas. We have to prove, too, that our ideas will either increase yields or give the same production at a lower cost.'

The job is as unpredictable as the weather and the many problems of the farmer can make it. 'The demand is always to be out in the fields when the call for paper work in the office is most insistent. The influence we can have on a farmer's profit can be dramatic – correct diagnosis and recommendation of say 6s. worth of 'Gammacol' can save crops worth £30 or more per acre. On the other hand, if we are wrong with perhaps a vegetable seed crop, which may gross anything up to £500 an acre, it could be a disaster.'

In the future, Eric James puts his faith in greater logical integration of farming operations: doing more things at the same time. 'Ultimately on many soils we shall use a machine that sprays 'Gramoxone' to kill weeds, sows seed impregnated with chemicals against insect and disease attack, places fertilizer along the rows and consolidates all in one operation. A far-fetched idea perhaps, but not quite as distant as it might seem.'

harvests of progress

the world their market – 1

Technical and commercial visits from PPL in 1967

Algeria 2
Argentina 2
Australia 1
Austria 3
Belgium 2
Brazil 2
Bulgaria 3
Cambodia 1
Cameroons 1
Canada 2
Canary Islands 1
Ceylon 1
Chile 3
Colombia 5
Congo 1
Costa Rica 1
Cyprus 2
Czechoslovakia 4
Denmark 5
Dominican Republic 1
E. Africa 4
E. Germany 4
Ecuador 2
Egypt 2
Ethiopia 1
Finland 2
France 6
Ghana 2
Greece 3
Guyana 1
Holland 3
Hungary 4
Iraq 1
Ireland 3
Israel 4
Italy 5
Ivory Coast 1
Jamaica 2
Japan 2
Jordan 1
Lebanon 1
Liberia 1
Libya 2
Malaysia 1
Mexico 3
Morocco 2
New Guinea 2
Nicaragua 2
Nigeria 2
Norway 5
Pakistan 1
Peru 2
Philippines 2
Poland 4
Portugal 2
Rumania 4
Russia 1
Salvador 2
South Africa 3
Spain 6
Surinam 1
Sweden 5
Switzerland 4
Syria 1
Taiwan 1
Thailand 2
Trinidad 1
Tunisia 2
Turkey 2
USA 2
Venezuela 2
W. Germany 6
Yugoslavia 4

Countries where volume sales of PPL products are established

North, Central & South America
Canada
Chile
Colombia
Costa Rica
Dominican Rep.
Ecuador
Jamaica
Mexico
Peru
Trinidad
U S A
Venezuela
Windward Is.

Africa
Egypt
Ghana
Kenya
Nigeria
South Africa
Sudan
Tanzania

Europe
Austria
Belgium
Czechoslovakia
Denmark
East Germany
Eire
France
Holland
Hungary
Italy
Norway
Poland
Spain
Sweden
Switzerland
United Kingdom
West Germany
Yugoslavia

Middle East
Israel
Turkey

Far East
Australia
Burma
Ceylon
China
India
Indonesia
Japan
Malaysia
New Zealand
Pakistan
Philippines
Singapore
Thailand

Resident Overseas Development Teams
Sales Agents
Associated Subsidiary Companies

harvests of progress

the world their market – 2

Alan Maier, Commercial and European Sales Director

'On the whole, development in Europe is quicker than in other parts of the world: European sales now form an important proportion of total sales.' As Commercial and European Sales Director, PPL, **Alan Maier** has both to safeguard and improve the gross margins of the company as a whole – export, home and retail – and to handle European sales: not only in Western and Eastern Europe but also other territories such as Turkey, Israel and Iran, which for PPL purposes line up more suitably with Western Europe.

'Some of this work is done through ICI (Europe) companies, some direct with local agents, and some through PPL's associated and subsidiary companies – Zeltia Agraria in Spain, Sopra in France, and Solplant in Italy. Prospects in France, the biggest agricultural country in Western Europe, for the bipyridyl herbicides are almost unlimited. Italy is more difficult: this market has always been slow to adopt herbicides and we shall have to persuade the Italian farmer to see their advantages. There is a continuous two-way traffic between PPL and opposite numbers in Europe.

'Sales in Eastern Europe have been slower to get moving because you cannot have agents based in the country. So we work direct with the State organisations concerned with agriculture, helped in USSR and East Germany by British firms who specialise in trade with Eastern Europe. But in Hungary, Czechoslovakia, Rumania, Bulgaria and Poland we deal directly with the nationals on the spot. Last year we signed a useful technical development agreement with the Hungarians, whose very competent agricultural research organisation will examine the use of the bipyridyls on a wide front and report on results.

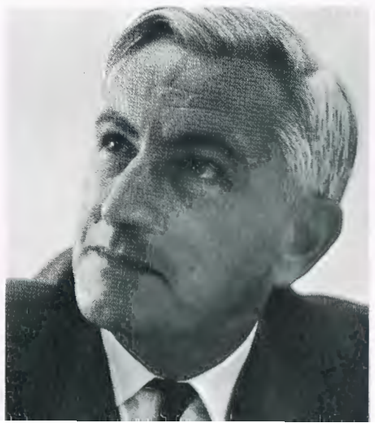
'In the USSR there is an enormous potential market for these products: cultivated crop acreages – nearly 300 million acres of cereals alone – are staggering in size, and if the techniques we are trying to promote are accepted, the tonnages of our chemicals sold there could be very high indeed. But the great difficulty in Eastern Europe at present is a chronic shortage of foreign currency. Here we are competing not so much with other companies selling agricultural chemicals, but for the foreign currency. The main problem is to persuade foreign trade organisations to use more of their budgets on our chemicals instead of on someone else's computers or packaging plants! But we have had some interesting sales and the future looks promising.'

Since 1962, exports of the bipyridyls have risen from 25 per cent of PPL's total sales value to almost 60 per cent. 'We were fairly quick,' says **Gerry Jenkins**, export manager of PPL, 'to recognise that these two products had unique characteristics. By increasing the rate of travelling for demonstrating throughout the world, we interested large numbers of people very quickly. And the degree of competition from compounds even approaching them in weed control potential is very small.'

Operating a world-wide sales effort on this scale demands co-ordination, specialised knowledge, and experience of many different areas of the world: 'We cover the world as a whole – something like 120 countries. And we have to know the countries: their agriculture, their crops, their economics, their politics – the general philosophy of agriculture and commerce in each one. Since no one man could know the world in such detail, we divide it up into convenient groups: America; Africa and the Middle East; the Far East; Western Europe; and Eastern Europe. Each area has its own Section Head.'

Gerry Jenkins

John Denize



The expansion of these markets has taught PPL some valuable business lessons: about the products themselves, about the crops, about the performance of agents, large, medium and small: 'Success with 'Gramoxone' has not generally been related to the size or status of a company or an agent, or to the numbers of people employed in the agricultural field. Some of the smaller companies have done very much better than the bigger ones. Another surprise has been the number of uses discovered – and developed – by our customers and not by ourselves.'

The technical service man at PPL links up with the overseas development and export departments. Acting above all as a commercial catalyst, he makes possible by his work in scores of countries a continuous process of market development. By costing his experiments and projects, he provides valuable advice to the export department to enable them to establish prices at an acceptable level. As **John Denize**, manager, Overseas Technical Service, explains: 'It's no good having the best product in the world if we cannot sell it. About 60 per cent of our total time goes on bipyridyl development, which already this year has involved 65 visits to 48 countries.' But the department does not merely go into a country, solve a given problem, and call it a day. The whole strategy is to build up the market for a wide range of products, using initial operations as a starting-point. A good example was in their approach to Central and South America: 'In the very early days of the bipyridyls, when we had already done well with them in the coffee plantations of Costa Rica, we realised that Central and South America as a whole presented an enormous potential market. So we began looking outside Costa Rica to the whole of this area. But we didn't restrict our attentions to coffee. There were other markets to go for, especially oil palm and bananas.'

The living and working conditions of the PPL technical service man abroad are many dimensions removed from his opposite number in, say, an industrial setting in Britain. To fly straight from London to the steaming heat of the Amazon jungle basin, right on the equator, or to work in Ethiopia in a dry heat of 120 degrees, is all part of the day's work. 'We work in a dynamic environment where change and innovation are constantly occurring: we're not dealing with a simple chemical relationship, a particular chemical applied for a particular process which is the same anywhere in the world. Weed problems are bound to be different from country to country even for one particular crop, because of the different conditions and techniques.'

harvests of progress

serving the farmer – at home

Only by covering Britain so intensively has PPL been able to cover the world so extensively. Expansion abroad owes a tremendous amount to the long-term development work carried out by PPL men at various levels direct with the farming customer at home. One man who has been quick to see what the company could do for his farm is **Dr. Gordon Dickson,** farm manager of the 4,000-acre Fitzalan Howard estate, mostly on chalkland near Arundel, Sussex – land not naturally fertile:

'Before 1939 this land was given over to rabbits and ponies, with the odd sheep here and there. It was of very low value, with abysmally low food production levels. The soil is basically infertile, because the water drains away through chalk so fast, taking with it the mineral salts. So until chemical fertilizers and machinery based on the tractor, came along, and herbicides for weed control soon after, economic cereal production was impossible. By giving us a tool for grass weed control, 'Gramoxone,' PPL have helped us to produce cereals on chalk on an economic basis. We farm these 4,000 acres – quite a large farm by British standards – and our three main enterprises are cereals, dairy cows, and ewes.'

Dr. Gordon Dickson (left) examines grassland with Eric James of PPL

'Without 'Gramoxone' we could not farm this land as intensively as we do.' Dr. Dickson tests the moisture content of some corn grown with the 'Gramoxone' technique on the Fitzalan Howard Estate, Sussex

PPL's main contribution to crop production on this estate has been weed control in cornland, using the relatively cheap and straightforward MCPA spray to control what were then fairly common weeds like charlock and thistles. 'Over the past five years, this spray has destroyed most of these, but in their place have risen other weeds, harder to kill. Here, too, PPL has come up with an answer in the wider-spectrum, more effective weedkillers produced for these very weeds. More recently we have been using 'Gramoxone' to eradicate grass weeds in corn and in stubble to prevent them forming a barrier to cultivation.

'We have also used it to renew some of our poorer permanent pasture, where the soil is too shallow to plough. In the Arun Valley, you've got low-lying water-meadows, or "brooklands," with only about four inches of soil overlying a very thick, sterile, and heavy clay. To plough up this clay only brings disaster. With 'Gramoxone' we can kill off the existing sward with the spray, and then directly re-seed into the dead sward the productive rye-grasses we want to sow. This steps up production of permanent grassland.

'A further use is where we're producing milk from grass. Our cows are on full milk potential in the autumn, often after calving in late summer, and we must keep them at a high level of lactation. Therefore, we have been keen to exploit kale as a supplement to grass. But for many years now the traditional methods of growing kale – ploughing, seeding, then struggling with labour shortages to keep a kale crop ahead of the weeds – have become more and more open to question, and increasingly costly too.

'So over the last three or four years we have used 'Gramoxone' to kill grass, through which we have direct-drilled kale. By killing the sward we are eliminating the weed problem in our kale in advance. This has also heavily cut cultivation costs: we only have our fertilizer to apply, and with the new drill which the engineering section of PPL have pioneered for us, we can inject into the dead sward enough kale seed to grow strongly without competition from weeds. This dead "mat" is a binding agent, which, in the autumn, when we have to graze this kale off, possibly in wet conditions, makes a platform for the cattle to stand on. It either supports the machinery if you want to cut the kale for the cows – or the cows themselves.

'On our farm in Yorkshire, sited on blowing sand and quite impossible to plough, we have used 'Gramoxone' to establish cereals. This year we tried direct drilling following 'Gramoxone' treatment to avoid the need for cultivation and completely avoided loss. I think direct drilling can overcome this kind of crop hazard. The new PPL drill which inserts the fertilizer near the seed with a special device, we found worked very well indeed. The essential on any land low in potash is to get a placement of the fertilizer near the seed, not just at random in the soil. The PPL drill embodied all the principles of combined drilling and fertilizing.'

harvests of progress

serving the farmer – abroad

Few countries produce so much food in so small a space as Holland. And in the Common Market, few countries face such fierce competition in crops like tomatoes (of which £31,000,000 worth were exported in 1966), apples, cucumbers, from other countries with more land and cheaper labour. So it is not surprising to find that Holland uses more 'Gramoxone' per acre than any other country in the world. One of the team responsible for this rapid growth is **Dick de Graaff,** sales manager of Pest Control Products, a section of ICI (Holland). He is seen, top left, with an apple-grower in his orchard.

'The market-gardener, the farmer, and the grower face competition not only in Holland but also in the main Dutch export markets. One of the main things that makes it possible to compete is a low cost price. The most important cost element is the cost of labour. Here the new bipyridyl herbicides are helping the farmer and the grower considerably. In glasshouse growing, for example, a highly-developed and very capital-intensive industry, the soil inside the actual glasshouse is of very great value and the grower must therefore keep it in the best condition and free of all contamination. If you use herbicides with a residual effect outside the house, there is always the danger that some of the herbicides will creep under the walls or will be taken inside the glasshouse on men's boots or clothing or by transport of earth, etc. When the grower uses 'Gramoxone' outside he can be sure that there is no danger of this because it has no residual effect in the soil at all. Another example occurs in fruit-growing, also a highly-intensive industry in Holland. The acreage of apples is 87,500. We have all bush-trees growing in lanes, with a strip of grass in between for the tractors to be driven over solid ground. To keep these lanes free of weeds, you have to apply herbicides repeatedly, and if these are residual in their effect you have the danger of a harmful effect on your trees through percolation. With 'Gramoxone,' however, this danger is removed. However many times you apply it on the lanes there can be no danger of such effects. And it kills fast, too. Used under the trees, it creates an organic mulch round the trees which enriches the soil. As each generation of weeds comes up, so it can be killed by repeated and precise spraying, creating several layers of extremely useful mulch.'

In yet another way, 'Gramoxone' is helping the Dutch with their age-old, ever-present problem – canal maintenance: 'As the only product effective in water, and also the only herbicide permitted by the authorities for subaquatic weed control in canals, 'Gramoxone' has a unique role to play. We have here in Holland 282,000 miles of ditches in constant use for drainage. Because nearly one third of the country is below sea level, we rely on these canals for pumping out the water into the sea. These canals must be kept free of weeds in order to pump the water through as rapidly as possible to its outlets in the North Sea. By desiccating and disintegrating these weeds completely 'Gramoxone' has provided an excellent answer to the problem, and we can confidently expect a very big turnover indeed in the future.'

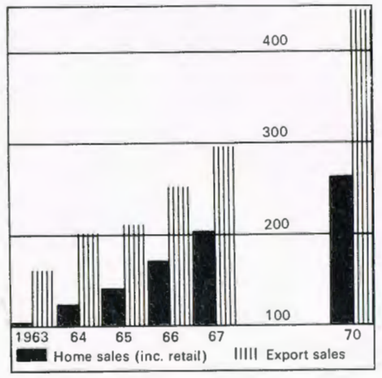
Photographs: Otto Karminski

harvests of progress

today and tomorrow

'Twenty years ago the contribution of PPL was a service in the form of specialist products to prevent disease, control insects and kill weeds. Today we can transform crop production techniques in a more fundamental way.' As chief executive on a day-to-day basis, **Wally Johnstone** describes his job as 'monitoring and co-ordination in this many-sided business of ours. Primarily we are a marketing company with a strong research base. On the marketing side we employ teams of experts in farming, highly-skilled in scientific agriculture, temperate or tropical, and in modern marketing techniques. Backing them up is a small commercial department, plus a team of economists who make market surveys to assess the potential for our products in any country that interests us. Then at Yalding, our formulation works in Kent, we have a small group of engineers and chemists who produce formulations for the various products. But we don't do large-scale manufacturing ourselves: ICI Divisions, mainly Mond and Dyestuffs, make our basic materials.'

Wally Johnstone: Managing Director



1962 = 100. Since then, export sales have almost trebled

The company's export success owes much to progressive growth in the home market over many years, while this growth itself is based on a number of discoveries going back to the forties: 'We are now the leaders in the UK crop protection business – an achievement which sprang originally from our discovery at Jealott's Hill in 1942 of the hormone weedkiller MCPA, and later of benzene hexachloride insecticide, which enabled us to offer the farmer a dual-purpose seed dressing, to protect his cereal crops against diseases *and* wireworm. Coming at the end of the war, these products really put PPL on the map in the UK. The next big discovery came with the bipyridyls in the fifties, and these are being exploited in a far more purposeful manner.'

A very important part is played by the 400-acre Fernhurst estate near Haslemere, Surrey, acquired by PPL in 1946 (and today their administrative HQ) as a demonstration centre for growing specialist crops, especially apples, tomatoes, carnations and chrysanthemums under glass, and market garden crops, including strawberries, in a very big way. 'These are all highly-susceptible to disease and to weed competition, and enable us to demonstrate forcibly the benefits of modern crop protection and crop production techniques. Up to 3,000 visitors a year from the UK and overseas come to see what we do, and the results. And all these operations are realistically costed, too.

'In the home retail market we have also secured a leading place as suppliers to the amateur gardener of chemicals which have become a household word throughout the country. These products go out under the ICI, not the PPL, banner, a marketing strategy which has paid off strikingly well in terms of increased turnover in the last few years.

'But to advance – and above all to compete in world markets with other major chemical companies – we must keep investing in research and development, and we must intensify and refine our marketing effort. In the next few years, in particular the next two, we must mount a bigger marketing operation than ever.'

'The number one lesson,' concludes **Bob Hamilton,** Chairman of PPL and a Deputy Chairman of Agricultural Division, 'is: keep ahead technically and so establish and maintain product leadership. We must have the men with inquiring minds, men who challenge almost every agricultural practice, however well-established, question every assumption and are determined to find a better way. The number two lesson is: exploit the technical innovation with development, manufacture and sales effort at the right time and the right speed – on the right scale.'

In the past, he feels, some discoveries in our field were not always developed quickly enough or strongly enough, but the story of the bipyridyls has been rewardingly different: 'A real tribute is due to Mond and Dyestuffs Divisions for going ahead so decisively with the manufacture of these products by new and sophisticated processes on large plants at such an early stage. In PPL and in the manufacturing Divisions alike, it is vital to have key men who can spot the world potential of a product very early on, so that development and production can go forward fast enough and products be established throughout the world before patents run out, competitors get alongside you with other products – and margins go down....' PPL, he considers, could not have done what it has if it had dealt only with British problems, only with the home market. The amount of research and development needed, and its cost, go far beyond what the home market could support. The leader in Britain, PPL is now among the top dozen companies of its kind in the world, yet this widespread activity is generated and maintained by a relatively small total number of employees with a breadth of outlook as large as any big ICI manufacturing Division. 'We concentrate on selling a technical effect, achieved through as little as a few ounces per acre of our products, rather than large tonnages of material. And you can only do this with a team having first-class and first-hand knowledge of farming conditions all over the world.'

Bob Hamilton: Chairman

The original idea of setting up the Research Station at Jealott's Hill came from ICI's first chairman, Lord Melchett: 'Back in 1927,' Bob Hamilton recalls, 'he conceived the idea of a station which would carry out research work not just for the UK farming industry alone, but would act as a centre of research for world agriculture – a spearhead for developing products to be made by ICI and used on a world basis. A glance at the map on p. 152 shows that today, 40 years later, this is indeed happening.

'When one thinks more deeply, in addition to the satisfaction of achieving profits for the Company, there is also the knowledge that our work, if successful, will add greatly to the welfare of millions. In the longer term, even to feed the rapidly increasing population at the present often meagre level, the world is going to need to double its food production in the next thirty years. Yet standards of living will also increase, and so, with the pressure for greater productivity, the use of agricultural chemicals will become even more important. Our aim for the future, then, is to align ourselves with this great need, which is also for us a great opportunity.'

paint salesman

When Paints Division introduced 'Dulux' to the retail market in 1953, it did so against a background of success in selling to trade customers and professional users. The growth since then of ICI's business in decorative products has been phenomenal, and 'Dulux' is now top dog in a market variously estimated as worth £80 to £100 million a year. More recently the Division has successfully added wallpaper and 'Vymura' to its range. Selling these products against fierce competition requires a highly-skilled sales force. John Watkins is one of over 130 representatives who between them look after the Division's trade and retail interests in the field. He joined the Division in 1957 and currently covers the West Essex area, where he is responsible for selling to 1500 trade users and specifiers against stiff competition from 30 to 40 other large paint manufacturers.

His territory represents a good cross-section in terms of both geography and customers. It stretches from the borders of Suffolk and Hertfordshire to the Thames estuary and includes dense areas of local authority housing, residential commuter towns and a 'new town' development – at Harlow. Industries in the area range from oil refineries and one of the largest car factories in the country, to breweries and plants making such varied products as processed foods, glass bottles and television sets. All these provide valuable opportunities for important business in paints and wall coverings, and not only for new work but also maintenance painting.

His main objective is to decide which customers in his area are likely to be the most profitable. He has over 1500 actual and potential customers and can make a maximum of around 1500 calls each year, so selective selling is vital. At least 1000 of these possible clients will be small builders and decorators, frequently employing fewer than five painters. Regular calls on this kind of customer are often ineffective, as the 'governor' is out all day on the job with his men. John Watkins' aim, therefore, is to concentrate on the 500 large trade users in his territory. These include ten merchants, through whom virtually all Paints Division's decorative products are distributed in West Essex and whose own representatives look after the 'smaller' customer. Others are 50 private architects and surveyors, 8 local authorities, 15 hospitals, 200 factories and about 200 medium-to-large building contractors.

A key element in his job is to maintain and develop close personal and working relationships with his important merchants, including their directors, managers and representatives, to persuade them to sell actively on Paints Division's behalf, and to seek new business jointly with them.

Although John Watkins is basically responsible for the trade sales of decorative products in his area, he could not achieve his very substantial turnover on his own without the strong backing of all the resources available from his Division. The Technical and Colour Advisory Services help him to solve customers' problems and to provide important specifications. The distribution service sees to it that the merchant – and the customer – receives his materials whenever and wherever they are required. Lastly, where large paint contracts are involved and some responsibility for the decision may rest with clients outside his own area, the speed and cooperation of his colleagues can often determine success or failure.

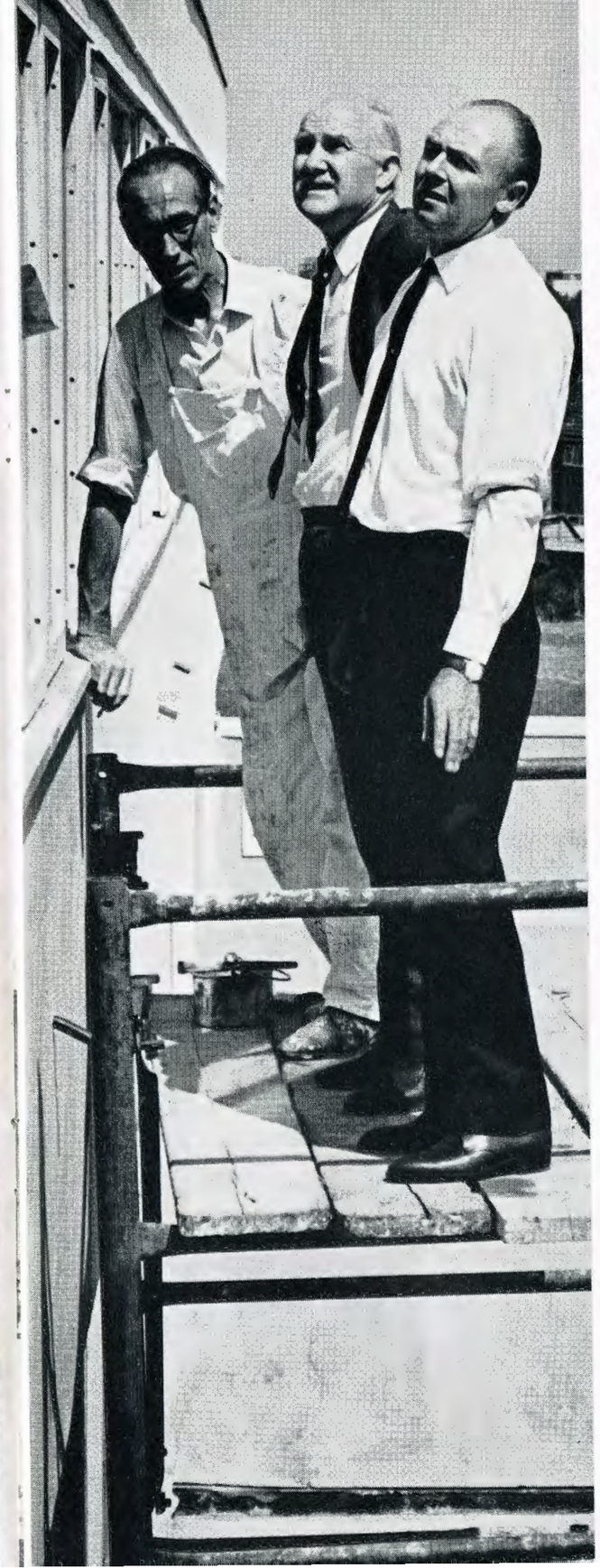
HAINAULT: Biggest of the ten ICI paint merchants in John Watkins' territory are F. C. and R. G. Turner Ltd. They are one of the largest ICI merchants in the South of England. An account of this size demands frequent visits to meet the merchants' own salesmen and to discuss new building projects in the area. At their Hainault depot with directors Mr. R. G. Turner and Mr. K. B. Watkin, John Watkins telephones Paints Division's Romford depot to arrange a quick delivery of 'Epibel' floor paint for an urgent factory job at Magnavox Electronics Ltd., Barking. Turner's carry the complete range of colours on the ICI trade and British Standard ranges, and they receive regular deliveries of paint from Romford every day.

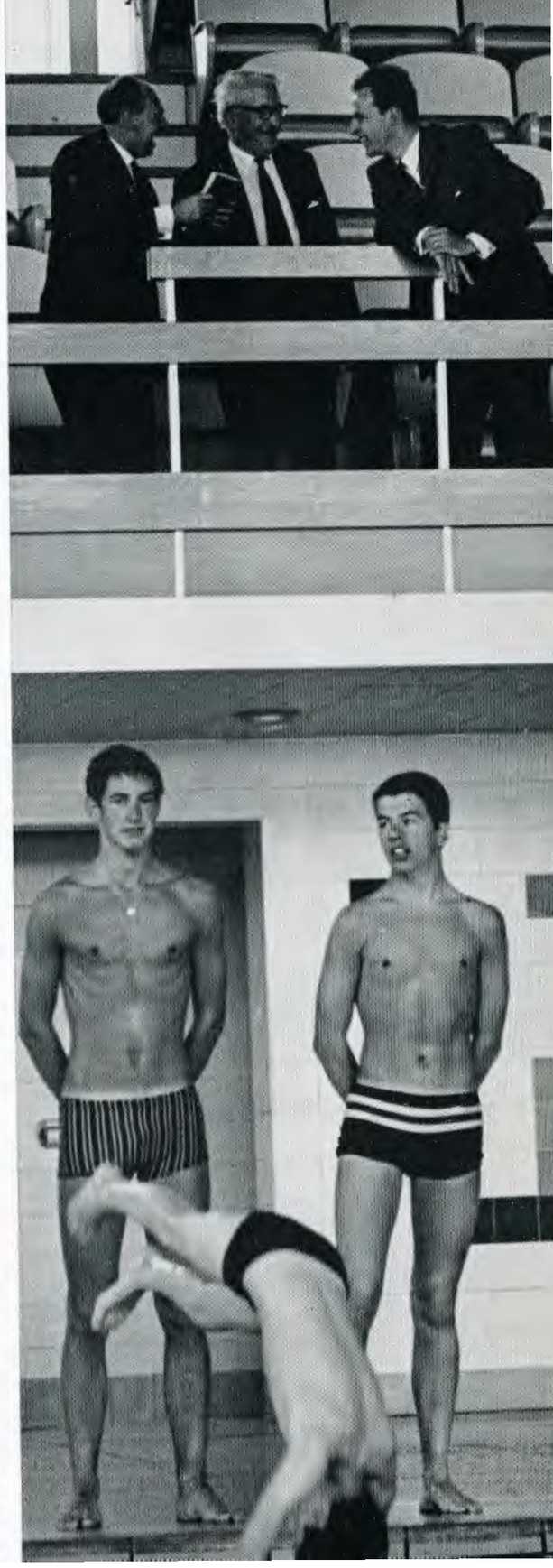
Photographs: Malcolm Aird

CHIGWELL: The Bowls, Chigwell, is a luxury development of over 100 flats which will sell at prices from £12,500 to £25,000. Designed by Stanley Keen, a Brentwood firm of architects, and built by T. A. Clark (Ilford) Ltd., they are being painted throughout in 'Dulux.' 'Vymura' will be extensively used for interior decoration and 'Dulux' polyurethane varnish as a protective finish on the matchboard ceilings of the entrance hall and corridors. Here John Watkins shows Mr. E. R. Bryan, a partner of Stanley Keen, 'Glazetite': a thick wall-coating, it is an American development made by ICI under licence.

HARLOW: Staple Tye Neighbourhood Centre, now under construction at Harlow New Town, will have a shopping precinct on the first floor, with maisonettes above and garages at ground level. Designed by the Harlow Development Corporation, the centre is being built by Sindall Ltd. of Cambridge. The painting subcontractors are R. B. Porch of Shefford, Beds., and 'Dulux' paints are being used throughout. On a routine site visit to check work in progress, John Watkins, seen with Mr. A. J. McCowen, deputy architect of Harlow Development Corporation, inspects window sashes already coated with 'Dulux' No. 2 Wood Primer.

GRAYS: Few places present more difficult painting conditions than a swimming pool, with its humid atmosphere. Grays swimming pool and civic hall, built by contractors Thomas Bates Ltd. to a design by the chief architect of the Thurrock Urban District Council, will be closed in January for repainting. For the original painting scheme the contractor chose 'Dulux,' with 'Kemobel,' a chlorinated rubber paint, for the diving board structure and the window frames of the pool area. John Watkins arranged a meeting between the architect Mr. H. K. Brown (left) and an ICI colleague Ian Jefferies, the technical service area representative. Jefferies was asked to report on treatment for certain parts of the paintwork.





paint salesman

PURFLEET: At the Purfleet Stork margarine factory of Van den Berghs and Jurgens, ICI paints are used on everything from the machinery in the plant to the works canteen – for which the colour scheme was planned by John Harman of the Colour Advisory Service at Slough – and the exteriors of storage tanks for edible oils on the factory's tank farm by the Thames. John Watkins and Mr. S. M. Shaw, works engineer, inspect the underside of a cooker. These cookers presented a problem because of the very high temperature of the steam-heated jacket, and 'Dulux' machinery enamel has been used on ICI's recommendation.

ORSETT: Work began in 1963 on the multi-million pound rebuilding programme at Orsett Hospital and should be completed by next year. Contractors are Thos. Bates & Son Ltd. of London and Coventry, John Watkins' largest building contract customer. As work progresses, the older hospital buildings are being demolished. ICI paints have been used at all stages and 'Vymura' to decorate the nurses' quarters and waiting rooms. On a contract of this kind John Watkins often consults the technical service area representative, Ian Jefferies. Here, watched by Watkins and Mr. T. J. Bates, Jefferies uses an Aquatrace in order to check the moisture content of a plastered wall surface to see if it is dry enough to paint.

LONDON: As a representative for West Essex, John Watkins answers to the London Sales Office at Templar House, High Holborn. He telephones the office at least once a day and calls in from time to time. With Michael Hunt, a correspondence clerk at Templar House, he picks suitable patterns of the new 'S' papers from the 1968 Walflair range to send to a local authority architect. Hunt acts as liaison man for three area representatives, writing to customers and handling telephone queries.

Akademgorodok–city of science

Tony Osman

It takes breadth of vision and courage to set up a new city in the forests of Siberia, and much more to decide that the city shall be a scientific one. The Soviet Union is accustomed to grand decisions, but it has often found that the mere decision is not enough, and that the achievement does not occur. I went with a group of British science writers to Akademgorodok, the scientific city set up just outside Novosibirsk, the administrative centre of Siberia, to find out what had been achieved there during its ten-year life.

Before I left Moscow, Mr. Gvishiani explained the reasons for founding Akademgorodok. He is vice-chairman of the State Committee for Science and Technology, and also Mr. Kosygin's son-in-law. He urgently wants to improve the quality and design of Soviet industrial projects and to harness the resources of the country. This is one of the reasons for the founding of Akademgorodok. To a quite extraordinary extent, Soviet society has become concentrated in the great cities, partly as a deliberate result of a policy designed to eliminate the peasants as a class, and these cities are all in the West. The area to the east of the Urals, where Siberia starts, was virtually undeveloped ten years ago.

No nation can afford to ignore its natural resources, and although Siberia is rich, not surprisingly, in wood – vast areas are covered in pine forests – very little else came from there. This vast area – nearly five million square miles – even now has only 25 million inhabitants, five per square mile. There are 581 per square mile in the United Kingdom. Britons tend to feel a bit lonely in Siberia.

Obviously the area should be developed, and obviously scientific research, leading to new and improved industry, was needed. Fortunately, a number of scientists decided that establishing a new centre would be good for science. Lines of research tend to become fossilised, especially in a rather bureaucratic society, and it is difficult to start institutes for cross-disciplinary studies in an old city.

The most important person in the decision to found Akademgorodok was Mikhail Lavrentyev. He is a distinguished mathematician, and not young, according to the calendar. He was 57 when the decision was taken ten years ago, but his manner is still very lively and he has an appealing lack of respect for authority. He argued, on economic and scientific grounds, for a scientific foundation in Siberia, and when the project was agreed, had to decide where to found it. Five million square miles allows a bit of choice. It had to be within striking distance of some town, as otherwise communication would be impossible – although the trans-Siberian railway is kept open throughout the year, there is no other communication across the country apart from the aeroplane, which would be no use for moving building materials. It was decided that the academic city should be near Novosibirsk. This is still not a large city, although it has some factories and is on the trans-Siberian railway. It is surrounded by the forests, the Siberian taiga, as it is called. Lavrentyev surveyed the area from an aircraft. An area called Wolf's Gulley seemed about right: the forest was not too dense, and a river was near. Lavrentyev climbed a tree in the area, pointed out what he considered to be the ideal spot for town centre, and, essentially, decreed that one should come into being.

There were no inhabitants then. Now, ten years later, there are 40,000. The city was built quickly, and there was no question of waiting for the seasons that suited building best. Boiling water was used to mix the concrete, and the well-constructed but rather utilitarian buildings that characterise the Soviet Union went up in a hurry. They talk, out there, of doing things at Siberian speed, meaning getting on with them quickly, and the Institutes shot up at Siberian speed. I had to do a certain amount of Siberian speeding myself.

I caught a plane that left Moscow rather after midnight, a turbo-prop that, I suppose, roughly corresponds to our Viscount. Soviet citizens are not generally anywhere near as tall as I am, so there wasn't enough leg room, and the seats were covered with some sort of rough carpet. I hadn't previously tried going to sleep in a cramped position on carpet and I found that I couldn't. This was depressing, but I wasn't very upset. I had a lot of books to read and I expected a meal. Reading turned out to be difficult – it was not possible to get the reading-light pointed at the book, and the main lights were sensibly turned down so that any short passengers with insensitive skins could go to sleep. However, there was a meal.

'Father' of Akademgorodok: Mikhail Lavrentyev, the president of the Siberian branch of the Soviet Academy of Sciences
Photograph: Morning Star

Meals throughout the world are served with the minimum regard for the convenience and pleasure of the eater that the server can get away with. Railway meals are perhaps the extreme case, with dinners served at some comical time like 5.30 so that the staff can leave the train comfortably as it arrives at 8 p.m. Hospital meals run to the quaint timetable of the hospital. Aircraft mealtimes have some of the eccentricity of hospital mealtimes, but with rather more excuse. If a flight lasts from midnight to five, there is no normal mealtime included. A meal, on the other hand, must be served. Someone, somewhere, probably never travelling outside normal mealtimes, has decreed it. So the air hostesses serve it.

At about two in the morning the lights go on, and everybody is woken and offered a meal. The fact that the pangs of hunger must be fairly unnoticeable if the passenger can sleep through them is irrelevant.

After the meal the journey dragged on until the plane landed at Novosibirsk. By then it was five o'clock . . . at least that is what the airport clock said. But it was actually eight o'clock in Novosibirsk: the airlines worked throughout the

Akademgorodok – city of science

Soviet Union, I was told, by Moscow time. Three hours of the snooze I had promised myself had just disappeared as we flew towards the sun. A bus was waiting, and I had my first ground-level glimpse of Siberia.

The bus rattled through open country, with occasional wooden houses in what I soon realised was a typical design. We had to wait some time at a level crossing for a very long train to pass, which was presumably going to Vladivostok, eventually, for this was the trans-Siberian railway.

this shows itself it is quite unusual. There are probably quite a few physicists who are sure that their work is of value to society, but to nearly all, the work is paramount. If it is very expensive – and nuclear physics usually is – then the community must provide the enormous amounts of money that the scientists consider essential.

Budker's mind worked differently. To him it was clear that high-energy physics was becoming too expensive. The cost of a projected accelerator, necessary research equipment for the nuclear research laboratory at Dubna, would be roughly equal to the budget of a small state. Only some new kind of accelerator could bring nuclear physics down to a reasonable cost. New accelerators and a new approach would best be started in a new laboratory and it was this that inspired Budker's move to Siberia. One problem was that there would have to be some attraction to get other scientists to come there.

Some key men of Akademgorodok: Academician Budker, nuclear physicist; Professor Voroshtsov, Director, Institute of Organic Chemistry; Professor Belyaev, geneticist; Academician Voyevodski, physical chemist. Altogether they control 40,000 scientists Photograph: BBC

We arrived at the outskirts of Novosibirsk, drove around it and then on the twenty miles or so to Akademgorodok. I had a vague impression of large blocks of flats, and grass and pine trees, and then we arrived at the hotel. It is difficult to describe, but the aspect was welcoming; Scandinavian is a word that comes to mind, presumably because it backed on to pine trees, with nothing else in sight in that direction, and because the design was pleasantly modern, making use of a lot of wood. Somebody started to talk about a meal.

By now all was clear. There was going to be no snooze, and apart from a meal, I was going straight in to meet my first Siberian scientist, Andrej Budker, a nuclear physicist and one of those behind the founding of the city. The prospect of discussing nuclear physics after a sleepless night was daunting.

In Siberia, it turned out, it was quite reasonable. I felt a bit the worse for wear, but Budker produced coffee, and I had already had breakfast, and I found I was fully ready for a session on nuclear physics. I'm glad I was. Budker is a brilliant physicist and a highly original one, and also one who is strongly influenced by social considerations. In the way that The grand uniformity of the Soviet Union makes it illegal to offer more pay, so he could hope only for those who were attracted by the project itself. In a way, this was ideal. Only young, unestablished, keen scientists would take this sort of risk, and this was just the sort of man and woman – there are plenty of women physicists in the Soviet Union – he wanted to work with him.

It is these people that give Akademgorodok its atmosphere. The city is a Scientific New Town. Everybody here is a scientist, or works to support the scientists as a technician, or running shops, laundries, and the other industries of the town. There are 60 members of the Academy and 1,500 post-graduate research scientists. And they are keen. One man I was talking to excused himself, saying that he had to go off to lecture, at six in the evening. To whom, I wondered – a night shift of students? 'The workers,' I was told, 'who come in for evening classes.' There is no real industry in Akademgorodok, so I was not quite clear where the workers came from. It turned out that they were the laboratory technicians, who were studying in their spare time.

The hardware, the actual machinery, was fascinating. Physicists deal with ideas so extraordinary that you need to see the experiment for reassurance. One of these devices produced collisions between an electron and a positron, which is a sub-atomic piece of antimatter. In fact it is the antimatter equivalent of the electron. Antimatter seems in all experiments to be the same as matter, except that when a particle collides with its normal, 'matter,' equivalent, both disappear. There are suggestions that there might even be an antimatter universe, indistinguishable from ours, until they meet. There may be some comfort in thinking that if an antimatter flying saucer were to land here it would disappear, leaving a flying-saucer shaped hole. It all sounds so odd that it was difficult to believe that I was looking at an antimatter generator; I was even shown some film of the experiment, the matter disappearing in a burst of light.

Off to lunch, and then in the afternoon to the Institute of Cytology and Genetics. This was obviously enormously important as a commercial proposition. Not many crops grow easily in Siberia, naturally enough, and one of the laboratory's tasks was to produce strains that would survive. The Director, Professor Belyaev, said that they used X-rays to produce mutations of seeds – which it certainly would – and that selection of these new varieties gave the strains he wanted. He listed early-ripening wheat and varieties with short, strong stems that would resist storms as examples of his success. These strains have certainly been developed, and presumably he got them by irradiation, although Western geneticists do not rate the method very highly.

As a tribute to the fact that I had already had a 32-hour day, there were no more visits. This gave me some time to look at the town itself. It was spacious and open – wide streets, footpaths separated from the roads by grass, and on the other side grass, and trees. Many of the scientific institutes were along one wide avenue; they were undistinguished concrete buildings like many institutes all over the world. Everybody lived in flats – private houses are very rare anywhere in the Soviet Union.

On the next day I went to some more institutions, and I also took the opportunity of finding out how people lived in Akademgorodok and what they did in their spare time. People were obviously paid quite well. Food was extremely expensive in the supermarket if one used the official exchange rate. This probably overvalues the rouble by 100 per cent, but even allowing for this, nothing seemed to be really a bargain. In Akademgorodok, as in most of the Soviet Union, wives have jobs and children spend the day being looked after, so a household's income can be quite high. And rents are low.

In the evening some people go to the only cinema, and I was told that they often see British and American films. Some people go dancing, and there are clubs with live groups. These are decorous places – the men invite the girls to dance and see them back to their places, and the clubs close quite early. And people visit each other. All of this is in the warmer months. While I was there the temperature was in the seventies, but it really is very cold in Siberia in winter. You are shown films of people ski-ing; but the area is pretty flat, and the temperature drops to –40°C, even –50° or –60°C. People do not go pleasure ski-ing much in this sort of climate, and I suspect that they just stay indoors and survive. A Muscovite I met admitted that in the winter he tended to spend the evenings at home with a bottle of vodka.

My own large-scale vodka drinking came on the last evening of the trip. There had been some slightly confused multi-lingual discussion about what we were going to do; it was described as 'a drive into the woods and a drink, perhaps.' It sounded like a visit to the equivalent of a country pub. Visitors are expected to dress slightly formally out there, so most of us wore city suits. There were ten science writers, and roughly the same number of Siberians and Muscovites.

We drove in a coach literally through the woods – we left the road and bumped through and among the trees, and stopped by a lake. The Siberians started collecting wood and lit a fire, and the 'drink, perhaps' was organised. While one group grilled sausages on sticks, the others half-filled tumblers with tomato juice and then topped them up with vodka, carefully poured in so as to float on the top. These were called 'Red Maries' and were drunk rather quickly, and the glasses were refilled. The tomato juice had run out, but there was plenty of vodka. The Siberians have a definite scale of values.

A schoolboy from Soviet Asia. Hand-picked pupils from all over the Soviet Union attend a special boarding school, where they study advanced physics and mathematics Photograph: BBC

We had a wonderful time. They sang Siberian songs, and we replied with British ones. After a couple of hours we piled back into the coach – the laws are so strict that coach drivers never drink – and went back to the hotel, and drank the whisky we had bought in the duty-free shop on the way out. We were presented with rather lavishly illustrated books on the area, and we persuaded everyone to write something in them. It was a warm, friendly and, rather surprisingly, fairly sober evening.

This was just as well. We had to get up at six the next morning to catch the plane back to Moscow, and we spent the afternoon there. I occupied most of it with my daily task of making a transferred charge call to *The Times* in London, for whom I was reporting the trip. Then back to the airport and off to Armenia, where we landed at about ten in the evening, Armenian time. That was the catch. Armenian time is four hours behind Novosibirsk time, so that we had already been in some sort of action for twenty hours. And there were still speeches of welcome, a drive to the hotel, and a meal. I was glad that life in Armenia was not lived at Siberian speed.

people, projects, products

It is announced with deep regret that Mr. R. M. Currie, formerly Head of the Central Work Study Department, died on 28th August. He was 65.

Lord Beeching, an ICI Deputy Chairman, writes:

Russell Currie was my friend. I say so with pride, and I know my words will be echoed by an untold number of others who knew him, for he had a vast capacity for friendship. His encyclopaedic memory for people was matched by an affectionate interest in his fellows which was equally remarkable in its scope. He admired the great without blindness, he recognised ability without envy, and was quick to see the merits of lesser men.

Many benefited from Russell Currie's knowledge, for, either directly or by judicious advice, he helped to place a great number of people in positions which really suited them.

Within ICI his achievement was phenomenal. I was a newcomer to the Company myself when I shared a room with him in Nobel House and was therefore well able to appreciate the difficulty of becoming effective in such a large and complex organisation. Although his entry into the Company had preceded my own by only a few months, he had already become a centre of influence and started on the way towards becoming the most widely-met person in ICI.

To suggest that everybody always agreed with him would only diminish his achievement, and it would be fulsome to say that he was always right; but everybody who knows what he did will agree that his total contribution to the Company's own efficiency and to its external reputation was outstanding.

Having given the name Work Study to a group of old and new management techniques, he fostered their fair and proper use with the full force of his enormous enthusiasm and persuasive personality. Methods which had become suspect, due to misuse and neglect, became respectable again and were supplemented by the ready adoption of new techniques whenever they could be found or developed.

Underlying all that he did was a strong pride in the Company and a firm conviction that ICI should lead the way towards national prosperity. To that end, and using ICI's own achievements as an example, he interested people far and wide in the benefits that sound application of Work Study techniques could bring.

At home he advised the Armed Forces and other Government Departments, some of the nationalised industries, some trade unions, and many sections of private industry. Wherever necessary, he helped them establish their own Work Study organisations. His great work in this respect was recognised when he was awarded a CBE in 1957.

Overseas, his enthusiasm infected ICI's subsidiaries and spread beyond them in their respective countries. As a consequence he was invited to introduce Work Study and national productivity campaigns in India and Canada. He also became the first president of the European Work Study Federation, as well as having been the first president of the British Institute of Work Study a few years earlier.

Work Study was the field in which he made an international reputation, but it was more than that. It was the vehicle through which he gave effect to his great stimulating influence, through which he served many people, and through which he widened his very large circle of friends.

Countless people will feel his death as a sad loss and extend their sympathy to his wife and family.

Mr. R. M. Currie

Coal mine's 'Terylene'/nylon conveyor

This 'Terylene'/nylon conveyor belt runs at 10 mph, carrying 2½ million cubic yards a year of shale and rock from Westfield opencast coal mine in Fife, Scotland, one of the biggest hard coal opencast mines in Europe. Made by B.T.R. Industries Ltd., it has a 'Terylene' warp and ICI nylon weft and can carry up to 3200 tons an hour. The original conveyor belt – which was also 'Terylene'/nylon – carried more than 10 million cubic yards of overburden during the five years it was in use

WELDING WITH A BANG

Graham Hadow

Not far from the constant activity of Mond Division's Lime Works at Tunstead Quarry near Buxton, with its noisy lorries and clattering limestone hoppers, there is a small and apparently disused quarry on the other side of the railway. Often the only sign of life is a wooden hut at the end of a pot-holed track leading off the main road. A sign just by the gate reads 'Imperial Chemical Industries Ltd., Nobel Division, Field Station.'

This is the site of the Explosives Product Group's field station, where an entirely new technique for the welding of metals is now reaching effective commercial operation.

Stainless steel is of enormous importance for the construction of chemical plant in which highly-corrosive gases or liquids are used or made. Mild steel, although it is much cheaper, cannot be employed because it corrodes, produces impure end-products, and very quickly becomes so damaged as to be completely worthless.

Yet the other physical qualities of mild steel, its mechanical strength and so on, are just as suitable for plant construction. If the mild steel can be covered with a tough skin of stainless steel on the inner side of vessels in which corrosion could occur, substantial savings are possible.

After a long period of applied research and development work by Nobel Division experts, a new and economical method of welding stainless steel on to a mild steel base was perfected – first on a small scale at Ardeer in Scotland and more recently on a larger scale at Buxton. The method has now been extended to the cladding of mild steel with titanium and with copper or copper alloys such as bronze.

The Buxton site was chosen because it was conveniently near the Midlands, where much of the fabrication of steel and other metals is done, and it is so convenient for Sheffield that mild steel and stainless steel plates brought to the quarry in the morning can be welded and returned to the steelmakers in the afternoon. Already, however, the Division is examining the possibility of setting up a second site for this operation in Scotland.

The project is directed by David Cleland, a technical officer from the Division's Explosives Research Section at Ardeer. Two other Scotsmen are in the team carrying out the work – William Boyd, laboratory assistant and shot-firer, who is second-in-command, and Wally Dorrian, research worker.

The object of the process is to clad a thin sheet of metal on to a thick base plate so that they become a strongly-bonded unit which can be formed or otherwise handled just like a single piece of metal.

Using these plates, a process vessel can be stainless steel or titanium on the inside face but with the bulk of metal required for strength of cheaper mild steel. Made wholly from either stainless steel or titanium the cost would be ten to twenty-five times as much. The bonded metals give a combination of corrosion resistance and strength not otherwise obtainable. Similarly a condenser tube plate made from mild steel clad with bronze has the corrosion-resistance of bronze combined with the mechanical strength of mild steel. Indeed, the tubes can even be fixed into this tube plate with explosives to obtain the best possible results.

The welding process is carried out on a specially-prepared firing bed at one end of the quarry. A substantial ferro-concrete base, about 20 ft. square, has a 12 in. thick steel anvil, 8 ft. long by 6 ft. wide, embedded in it. This forms a permanent anvil for welding by explosives and supports the mild steel plate, which is commonly from two to five inches thick. On this plate is in turn placed the much thinner sheet of stainless steel (or titanium or copper alloy) for the welding operation.

About 100 lb. of TNT-based explosive powder is placed on top of the stainless steel sheet, a thick polythene sheet is placed over it, and several tons of sand are then dumped on top. A detonator is inserted into the end of the bed, and the detonator wire connected to a firing cable by the shot-firer.

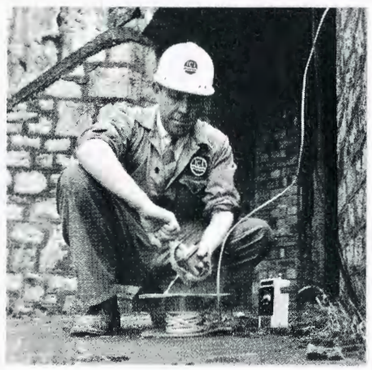
After the site has been cleared and all the necessary precautions taken, the shot is fired. As a result of the explosion, one intensely-powerful, even hammer blow is imparted. This produces an intimately-welded sheet of mild steel with a tough stainless steel skin, in good condition for the processing that it will undergo on its return to the steel mills before fabrication into chemical plant.

So far the field site has been used intermittently, but the products have proved extremely successful and the Division is confident that more and more of this explosive welding work will increase the activity at Buxton.

Some principal stages in the operation. Left: David Cleland, a Nobel Division Technical Officer, directs the positioning of the mild steel plate

Left, with Wally Dorrian (right) he lowers the stainless steel plate into position above the mild steel plate

Shotfirer William Boyd pays out the firing cable (right) and then (far right) fires the shot



WELDING WITH A BANG

After the bang. David Cleland tests the weld for accuracy with an ultrasonic tester

building at Knebworth

Editor: *Earlier this year, Mr. de Normann, the Building Development Group of ICI, of which you are Manager, launched the small Stockens Dell housing operation at Knebworth in Hertfordshire. How does this whole project fit in with the broad aims of the Group?*

John de Normann: ICI and its associated companies sell about £40,000,000 a year of materials and products to the building industry. About three years ago the Company felt the building industry had become so complex that some central body which could view it in the round and could take account of ultimate consumer requirements should be created. They set up the Building Development Group as a central body working on behalf of the whole ICI Group. Our aim is to understand the building industry and its requirements, and to bring to bear the technological skills of the Company on the materials, components and processes used in the industry.

Right from the start we realised that to make any advances we had to have a detailed knowledge of building operations as they happen on the site. Without this knowledge it was simply not feasible to use our technology fully. Therefore we concentrated on getting to know the industry from the inside, and we felt that to do this we must be associated with an efficient building organisation.

We cast about for a partner, and the result has been our 40 per cent holding in Howard Farrow Construction Ltd. of London. They are medium-sized builders with a reputation for high-quality work and advanced management techniques. As a result of knowledge gained from them, and from the Knebworth building operation, we are now beginning to identify technological targets in the industry for components and materials. And we are beginning to do something about them. We have also been able to help all the Divisions and associated companies of ICI who supply to the building industry by providing them with first-hand building-site knowledge, particularly on the installed cost and performance of their products.

Editor: *What is the specific purpose of the Knebworth project?*

J. de N.: In ICI we're inclined to think in terms of pilot plants and pilot operations which apply particularly to the chemical business. There is really a similar position in building, and if we look on Howard Farrow Construction Ltd. as a pilot plant, we can say the Knebworth houses were our first pilot operation. House-building represents more than half of the total new building work in this country, and every attempt must be made to introduce new technologies in order to stabilise the ever-rising costs. We felt that we could not get at this from a technological basis until we'd had first-hand experience of the whole house-building operation. We have bought land, designed houses, had them built for us by Howard Farrow, and then sold them to the public.

As a result we have now gained a very large amount of information on the use of our products and their installed cost, and have also identified a number of ideas for future development which over the next few years we hope to put into practice. This does not mean that we have any intention of going into the house-building industry. Just the reverse. Our sole object is to supply that industry with materials and components that they need to do their job; to help them to keep costs to a minimum, and to use the most modern materials in the most effective way.

Ceilings: **Spraying 'Lytex' texturing compound on to a ceiling made of Agricultural Division's 'Pioneer' brand plasterboard**

Walls: **'Pioneer' plasterboard is used for dry-lining brick walls. No drying-out time is necessary before decorating**

Damp Proofing: **About 70 lb. of 'Visqueen' polythene film has been used in each house for damp courses and roof-linings**

Insulation: **ICI Insulation Service technicians inject 'Ufoam' into cavity walls. This will save about 20% on heating bills**

Editor: *How many ICI products are concerned in your operations? Could you say how many Divisions are involved?*

J. de N.: ICI and its associated companies probably have a wider range of products for the building industry than any other company in the UK. When we last counted them there were over 100 products, without going into the different types of paint or wallpaper. Seven Divisions are concerned, together with quite a number of associated companies, ranging from Yorkshire Imperial Metals to Imperial Aluminium Company. Most of these Divisions and associated companies supply materials either in the form of products used in building, like plaster and plasterboard; or in the form of finishes, such as the whole range of paint and wallpaper and 'Vymura' products; or as fibres, which go into everything from curtains to carpets and the covers on the furniture; or as copper, used in nearly all building systems. When we built the Knebworth houses we were quite surprised to find that we had supplied from the ICI Group about 20 per cent of the total material value of the house, excluding textiles.

Editor: *Of the various products concerned, which are having notable success? And why?*

J. de N.: The whole use of plastics in building is very interesting. We found in these houses that we were using more than six hundredweight of plastics without in any way forcing them into any applications that didn't fit. Plastics soil and rainwater goods, plastics cold water plumbing and baths, for example, have a great future. Their maintenance costs are low and they are very light and easy to assemble. There will be another big advance when we've solved the problem of using plastics for hot water plumbing. We've also been able to

Drainage: **'Rymway' rigid PVC pipes and fittings are easy to handle on site, cheap to install and need no maintenance**

Exterior Walls: **'Impalco' pre-painted aluminium weather-boarding on outside walls gives a long, maintenance-free life**

use 'Visqueen' polythene roof sarking instead of the conventional felt, and after an initial period in which the roofers were getting to know it, it has been most successful.

Again, we feel there is a big potential for dry-lining techniques with plasterboard for finishing internal wall surfaces. It removes the necessity for wet plastering and it makes sure that a house is drier and warmer right from the start.

Low maintenance costs in building products are extremely important, really almost as important as the prime cost of the products. In these houses we've been able to use 'Impalco' pre-painted aluminium weatherboarding in place of painted wood at no great difference in installed cost but with many times the maintenance life.

Another interesting example of long-term cost reduction at Knebworth was the heating. We set ourselves to exceed the minimum official standards for housing without going way beyond the Ministry of Housing cost yardsticks, and we have done this. We chose for most of the houses ducted hot-air heating and for a few of them Nobel Division's 'Flexel' electrical ceiling heating. We found we could reduce the capital costs of the heating installation, as well as the running cost, by making a sounder job of insulating the walls, and for this we used our own 'Ufoam' cavity wall insulation. As a result, we've been able to reduce the size of the heating equipment and make other quite significant economies.

Editor: *So if the builder thinks harder at the beginning about maintenance costs, he can give the customer a better bargain?*

J. de N.: I'm sure this is right. I see changes coming in the building industry. Some developers are becoming much more concerned now with the maintenance cost of buildings and so more inclined to put thought into the operation *before* they build. I hope this goes on and becomes more and more accepted.

Editor: *What problems did this Knebworth operation present, and how did you solve them?*

J. de N.: First of all, we wanted to make sure the Knebworth project was a *genuine* project and did present the kind of problems a house property developer has to solve. So we formed a small separate company to ensure that we had correctly identified all the costs. Then we set up a little group with an architect, a quantity surveyor, a building technologist and a work study man working together. To help in planning, we brought in an expert on network systems. This was because we wanted to work quickly and to a programme. We started with a blank sheet of paper and went through design to planning and by-law approval in six weeks, cut ground last November, and completed the first house by 2nd May.

Bedroom **is decorated with 'Dulux' paint and 'Vymura.' The carpet is 'Bri-Nylon,' the curtains and quilt filling of 'Terylene' and the chair covering of 'Ambla' from ICI (Hyde)**

Bathroom **illustrates many uses of ICI plastics, including 'Perspex' bath, 'Opella' taps and 'Propathene' lavatory seat**

Photographs: Ronald Chapman

Living room **has carpet and upholstery in 'Bri-Nylon,' curtains of 'Terylene'/rayon, walls and woodwork in 'Dulux' and 'Vymura'**

Editor: *Who are your main competitors, and why?*

J. de N.: Our chosen field of activity is to bring technology to bear on the problems of the building industry, and our main competitors are other companies of equivalent technological ability. The oil companies and some of the large chemical companies at home and abroad are on the same course. True, there will be competition, but no one I know of deals at the same time with gypsum products, with a wide range of plastics, with a whole range of decorative products, with insulating foams, with aluminium and with copper.

Editor: *How are you going to help the builder to raise the quality of the product, help him to higher productivity and thus halt the rise in building costs?*

J. de N.: We are certain that in the years to come it's not going to be enough just to supply products to the building industry. One must give service, and in our view service to the building industry is the ability to demonstrate how to use products to achieve cheaper and more efficient building. We can do this in two ways. Technically, by identifying builders' needs and giving them the products that satisfy them, either by taking some of the component manufacture back into the factory or, just as important, by producing new site services, such as our insulating technology. But there is the economic side as well. As a service one ought to be able to give the builder some idea of the economic result of using one's product. One ought to show him that if he does use the products in the way we suggest, then he can raise his productivity by reducing overall cost.

We have made a detailed study at Knebworth of the entire site operation, using modified factory techniques which will enable us to assess, among other things, the potential increase in efficiency as work on the site progressed. With any new product, component or process, there is a very considerable degree of site learning by the building operatives, and this should be understood and known to the builder. At the end of the operation, when we've analysed all the figures, we'll be able in certain cases, with the products we've used, to show a direct economic gain to the builder.

Editor: *Could you give a character sketch of the building industry?*

J. de N.: It's very different from the chemical industry, in which I have spent all my life in ICI. It's a very complex industry, spread over a number of different partners. There's

ICI Show House **at Knebworth. Interiors were designed by Paints Division's Colour Advisory Department, the garden by Percy Thrower in association with Plant Protection Limited**

the client, who has to say what he wants; the architect, who attempts to design for his requirements; the quantity surveyor, who plays an extremely important part in determining the costs; the builder, who has to build it; and the supplier of the materials and components, who unless he has the knowledge gained from considerable experience in the industry finds it very hard to make any real contribution.

There is also the subjectivity of the client. I defy any architect to design a house that will please everybody, regardless of cost! This really is a consumer-oriented industry to which one must bring a market rather than a product approach. One must therefore have an organisation which comprehends the problems of the consumer. Just to make new products and offer them to the industry will not really get anyone very far.

Editor: *Does this tie up at all with the question of how far industrialised building can be taken?*

J. de N.: I see industrialised building as the organisation and management of the whole operation. It's not enough to look at it in just the narrow sense of making things in a factory and taking them to the site. As labour gets scarcer and inevitably more expensive on the building site, more and more components will be made in the factory and assembled on the site. But there is danger in going too fast, and we must all bear in mind the alternative of actually improving the operations carried out on the site. Ready-mixed concrete pumped on site is an excellent example of this sort of development; our 'Ufoam' insulation service is another.

Editor: *Have you got other priorities apart from housing?*

J. de N.: Yes, we are equally interested in schools and hospitals and in the general development of new components. Here a completely different approach is necessary. As far as schools and hospitals are concerned we are concentrating on our contacts with the relevant Government department and with the consortia and local authorities. There's a lot to be done in the component field for all these sorts of public building, and the bodies concerned are most anxious to make advances. These people are both cost-conscious and extremely professional. Furthermore the consortia and the buying groups could become so large that only very large companies will be able to deal with the contracts. The contract for a component for a school or hospital programme may be worth over £1,000,000. It needs quite a large organisation to meet the research and development charges leading up to such a contract and to make the investment to meet the contract.

Editor: *Would you like to say more about the development of new products?*

J. de N.: Yes, we have quite a considerable technological effort which accounts for a significant part of our total activity. We are interested not only in heat insulation but also in acoustic insulation. Many modern housing and other building systems are based on cast concrete, and we have been working with products which in one substance combine both the finishing surface and the insulation, and can be cast with the concrete directly in the mould. This may lead to certain changes in building which will bring economic advantage.

We've already started to supply these products to certain selected system builders. And we're putting quite a lot of effort into plastics plumbing for hot water. Although we believe that the right plastic material now exists for hot water, we must ensure that before this reaches the market we have a properly-designed overall plumbing system with the means of installation and of repair worked out so that we can instruct the plumbing trade. However, copper is so suitable for plumbing purposes that it will require first-class plastics products to displace it. We are also looking at the possibility of replacing certain softwood building products, which require regular maintenance, by plastics products which will have been found in practice to need no maintenance at all.

Editor: *How closely does the Building Development Group work with Divisions?*

J. de N.: When appropriate we work with Divisions, but in principle we are site-oriented, concerned with the total building operation. We do not work with materials. We don't design new plastics or gypsum products. We may tell the Divisions that a new material with a certain specification is desirable, but it's not our job to develop it. Our job is to make sure that we turn these materials, in many cases originating from more than one Division, into a product or component which is satisfactory for the building operation.

Furthermore we work closely with Divisions on the marketing front; for example the Group provides a central marketing research function for building products and also co-ordinates aspects of building products publicity wherever an overall company presentation seems commercially advantageous.

people in print

John Watkins

John Watkins has been a Decorative Products trade representative for six years. He joined Paints Division ten years ago from another paint firm. Earlier he was a deputy manager with F. W. Woolworth & Co. Ltd., which he joined in 1937 after leaving the Swansea Grammar School. During the war he was a pilot in the Royal Air Force. He is keen on deep sea fishing and is also a very enthusiastic caravanner.

Tony Osman

Tony Osman has just been appointed deputy editor of *New Scientist*. He was until very recently assistant editor of *Endeavour,* ICI's scientific review, and he has also contributed to *The Times* and *The Guardian* and written scripts for radio and television. As chairman of the Association of British Science Writers, he led a tour of the Soviet Union by the Association which included a visit to Akademgorodok, the science city in Siberia, about which he writes on page 164. He is also secretary of the International Science Writers Association. Interests include vintage cars—his present car is 'an elderly thoroughbred Bentley'—and he is working on a history of the Lagonda.

Graham Hadow

Graham Hadow is a producer for Millbank Films Ltd., an ICI subsidiary. After coming down from Oxford he studied stage production and later worked in the London theatre, in films and in advertising. He joined the then ICI Film Unit in 1946 as a script-writer/director.

John de Normann

John de Normann is manager of the ICI Building Development Group. Educated at Westminster School and Oxford, where he graduated in chemistry, he joined ICI in 1947, having served in the Royal Artillery during the war. After six years in the Southern Regional Sales Organisation, he was made personal assistant to Sir Ewart Smith, a former ICI Deputy Chairman. He then spent two years with ICI (New York). On his return in 1957, and before his appointment in January 1965 to the Building Development Group, he was research and development manager at Nobel Division. Interested in motor racing, he raced in well-known UK events for a number of years.

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magazine

Pierre Cardin is one of eight Paris couturiers who include models in ICI's 'Crimplene' fabrics in their autumn collections. This short tunic-style dress is in a smooth herringbone 'Crimplene' jersey in sage green